BABCOCK ENGINEERING SERVICES/SCOTTISH ENVIRONMENT PROTECTION AGENCY

DALGETY BAY MONITORING PROJECT – MARCH 2005

EXECUTIVE SUMMARY

Babcock Engineering Services carried out a radiological survey of areas of Dalgety Bay Beach and Foreshore Area on behalf of SEPA in March 2005. The objective of the survey was to detect and record any radium-226 contamination in the areas surveyed.

The areas of Dalgety Bay Beach and Foreshore Area surveyed were areas of sandy beach approximately opposite the entrance road to the Foreshore area down to areas of sandy beach next to the slipways, which serve the Dalgety Bay Sailing Club. These are the same areas surveyed in the last survey in March 2002.

The survey in March 2005 used identical methods and equipment to that used during previous surveys carried out by Babcock Engineering Services in 1997, 1998, 2000 and 2002.

Radioactive contamination was detected at ninety-seven separate positions during the survey in March 2005, with levels ranging from 30 counts per second (cps) above background to 2350 cps above background. The background count rate is 50 - 55 cps typically. These levels of contamination are consistent with the levels found in previous surveys.

The radioactive contamination was present as discrete items rather than widespread contamination. The form of the contaminant was identical to that observed in previous surveys. The exact locations of the radioactive contamination are shown in Figure 2.

1. INTRODUCTION

Radioactive contamination has been detected during past radiological surveys carried out at Dalgety Bay. The contaminant is radium-226 and is believed to have originated from the burning and disposal of luminised instruments from an old airforce base, which was decommissioned after the war.

This report presents the results of a further survey of Dalgety Bay Beach and Foreshore Area carried out by Babcock Engineering Services on behalf of SEPA in March 2005.

Section 2 describes briefly the history of contamination of the Dalgety Bay Beach and Foreshore Area. Section 3 describes the areas surveyed and methods used during this latest survey. Section 4 summarises the results of this survey. Section 5 is the conclusions. Appendix 1 contains the detailed results of this survey, for squares where contamination was detected.

2. HISTORY OF CONTAMINATION OF THE DALGETY BEACH AREA

This section describes briefly the history of contamination of the Dalgety Bay Beach and Foreshore Area.

Babcock Engineering Services discovered radioactive contamination at Dalgety Bay during a routine environmental survey in 1990 [1]. Samples of the contaminant were analysed, and the contaminant was identified as radium-226 (in equilibrium with its daughter products).

The contaminant appeared to be associated with discrete items of fused glass or grit. It is believed to have originated from the disposal of ash from the burning of luminised instruments at an old airforce base, HMS Merlin at Donnybristle, which was decommissioned after the war.

The National Radiological Protection Board carried out surveys at Dalgety Bay foreshore in the early nineties [2,3], to study the extent of the contamination. Contamination was detected regularly during these surveys. Where practicable, any radium contamination discovered during these surveys was removed for analysis and disposal.

Babcock Engineering Services carried out surveys of Dalgety Bay Beach and Foreshore Area on behalf of the Scottish Environment Protection Agency (SEPA), in 1997, 1998, 2000 and 2002 [4,5, 6 and 7]. Contamination was detected during all four surveys and approximately 0.2 m^3 of contaminated material was removed for safe storage at Rosyth Dockyard pending ultimate disposal.

3. METHODOLOGY AND AREAS SURVEYED

This Section describes the areas surveyed, and the methods used to carry out the surveys of Dalgety Bay Beach and Foreshore Area in March 2005.

3.1 Site

The survey site lies on the North Shore of the Firth of Forth, to the north west corner of Dalgety Bay.

The specific areas of Dalgety Bay Beach and Foreshore Area, which were surveyed, are shown in Figure 1. They are areas of sandy beach approximately opposite the entrance road to the Foreshore area down to areas of sandy beach next to the slipways, which serve the Dalgety Bay Sailing Club.

The 2005 survey site covered an area of approximately 1.75 hectares (17,500 square metres).

The areas surveyed in March 2005 are basically the same as those surveyed in March 2002.

3.2 Methodology

The survey in March 2005 used the same methods and identical equipment to those used during the surveys carried out in 1997, 1998, 2000 and 2002.

3.2.1 Site Identification

The main objectives in carrying out the survey were to:

- monitor systematically every square metre for radium contamination in the areas concerned, where it was safe and practicable to do so;
- record monitoring results in a manner whereby the results could be linked back easily to a 1 square metre area within the site.

To achieve these objectives a grid system was applied to the map of the site;

1. The site was divided into squares of 10 metres by 10 metres as shown in Figure 1, marked out using cones. Each 10 m x 10 m square was identified uniquely by a code consisting of a letter from A – N and a number, with the first square monitored being number 1, the second square monitored being number 2 and so on. For example, looking at Figure 1, there are fourteen 10 m x 10 m squares, C1 to C14, and there are eight 10 m x 10 m squares, N1 to N8 etc.;

2. Each 10 m x 10 m square is sub-divided into one hundred 1 m x 1 m squares, each square being identified uniquely by the combination of a letter (a to j), and a number (1 to 10).

3.2.2 Survey Equipment

The instrument used to carry out the survey was the Novelec DG5. This is a scintillation detector, which can detect the 188 keV gamma photon emitted by the radioactive decay of radium-226 and which has an appropriately fast response to changes in radiation levels. The limit of detection for this instrument for a point

source of radium-226 depends on the background radiation levels present, but has been estimated previously to be in the range 5 – 55 kBq [5].

3.2.3 Surveys

Before beginning the survey, the operator recorded a background count on the Novelec DG5. During monitoring, any increase of approximately 50% above this background reading would cause an audible alarm to sound. This level represents the lower limit of detection.

The Novelec DG5 was attached to a long handle, which allowed it to be used within 10 cm or less of ground level. The operator then began the survey by traversing each 10 m x 10 m square ten times, at 1 m intervals, at a speed of 1 ms^{-1} approximately (about two-thirds of normal walking pace). In this way he monitored effectively the entire square in a period of 100 seconds at a rate of 1 m^2s^{-1}.

All results, including negative results, were recorded in writing.

4. SURVEY RESULTS

This section summarises the results of the survey of Dalgety Bay Beach and Foreshore Area carried out in March 2005. Appendix 1 contains the full results of the survey for all squares where contamination was detected.

4.1 Results

Radioactive contamination was detected at eighty-eight separate positions during this survey, with levels ranging from 30 counts per second (cps) above background to 2350 cps above background; the background count rate is 50-55 cps typically.

The radioactive contamination was present as discrete items rather than widespread contamination. The form of the contaminant was identical to that observed in previous surveys. No items of contamination were removed from the site. The exact locations of the radioactive contamination are shown in Figure 2.

Further radioactive contamination was also indicated beneath the large boulders forming the breakwater in areas A4 – A9 and areas J7 – B13. Unfortunately, due to the nature of these areas, BES was unable to determine the extent of the contamination present in these areas.

It is assumed that the radioactive contaminant is identical to before i.e. radium-226. The fact that the form of the contaminant was identical to that observed in previous surveys supports this assumption.

4.2 Comparison with Previous Surveys

Babcock Engineering Services carried out surveys of Dalgety Bay Beach and Foreshore Area on behalf of SEPA, in 1997,1998, 2000 and 2002 [4,5,6 and 7].

In 1997 approximately 120 contaminated positions were detected. In 1998 radioactive contamination was detected at eleven separate positions. In 2000 radioactive contamination was detected at eighty separate positions. In 2002 radioactive contamination was detected at ninety-three separate positions.

The levels of contamination described in Section 4.1 are consistent with the levels found in previous surveys.

5. CONCLUSIONS

- Babcock Engineering Services carried out a survey of Dalgety Bay Beach and Foreshore Area on behalf of SEPA in March 2005. The areas surveyed are areas of sandy beach approximately opposite the entrance road to the Foreshore area down to areas of sandy beach next to the slipways, which serve the Dalgety Bay Sailing Club.

- Radioactive contamination was detected at eighty-eight separate positions during the survey, with levels ranging from 30 cps above background to 2350 cps above background. The background count rate is 50-55 cps typically. These levels of contamination are consistent with the levels found in previous surveys.

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observed in previous surveys. The exact locations of the radioactive contamination are shown in Figure 2.

- Further radioactive contamination was also indicated beneath the large boulders forming the breakwater in areas A4 – A9 and areas J7 – B13. Unfortunately, due to the nature of these areas, BES was unable to determine the extent of the contamination present in these areas.

- No contamination has been removed from the site.

6. REFERENCES

[1] RRD. *Foreshore Survey Dalgety Bay (NGR NT166835).* June 1990.

[2] NRPB. *Radioactivity at Dalgety Bay (NGR NT 166 835)*, Visit Report Number: NRPB/VR/4/1477, December 1990.

[3] NRPB. *Radioactivity at Dalgety Bay (NGR NT 166 835)*, Visit Report Number: NRPB/VR/4/1488, August 1991.

[4] BRDL/SEPA. *Dalgety Bay Monitoring Project Technical Report.* 1997.

[5] BRDL/SEPA. *Dalgety Bay Monitoring Project Technical Report.* April 1998.

[6] BRDL/SEPA. *Dalgety Bay Monitoring Project.* August 2000.

[7] Babcock BES/SEPA. *Dalgety Bay Monitoring Project.* March 2002.